**Geothermal Basics**

**What is geothermal energy?**

The word geothermal comes from the Greek words geo (earth) and therme (heat). Geothermal energy is heat from within the earth. We can recover this heat as steam or as hot water and use it to heat buildings or to generate electricity. Geothermal energy is a renewable energy source because the heat is continuously produced inside the earth.

**Most geothermal resources are near tectonic plate boundaries**

The most active geothermal resources are usually found along major tectonic plate boundaries where earthquakes and volcanoes are located. When magma comes near the earth's surface, it heats ground water trapped in porous rock or water running along fractured rock surfaces and faults. Hydrothermal features have two common ingredients, water (hydro) and heat (thermal).

**U.S. geothermal power plants are located in the West**

Most of the geothermal power plants in the United States are located in the western states and in Hawaii, where geothermal energy resources are close to the earth's surface. California generates the most electricity from geothermal energy. The Geysers dry steam reservoir in northern California is the largest known dry steam field in the world and has been producing electricity since 1960.

**Use of geothermal energy**

Some applications of geothermal energy use the earth's temperatures near the surface, while others require drilling miles into the earth. There are three main types of geothermal energy systems:

* Direct use and district heating systems use hot water from springs or reservoirs.
* Electricity generation power plants require water or steam at high temperatures (300° to 700°F). Geothermal power plants are generally built where geothermal reservoirs are located within a mile or two of the surface of the earth.
* Geothermal heat pumps use stable ground or water temperatures near the earth's surface to control building temperatures above ground.

**The United States produces the most electricity with geothermal energy**

The United States leads the world in the amount of electricity generated with geothermal energy. In 2014, U.S. geothermal power plants produced about 17 billion kilowatthours (kWh), or 0.4% of total U.S. electricity generation. In 2014, seven states had geothermal power plants.

*Share of U.S. geothermal electricity produced by each state, 2014:*

|  |  |  |  |
| --- | --- | --- | --- |
| California | 76% | Oregon | 1% |
| Nevada | 18% | Idaho | 0.3% |
| Utah | 3% | New Mexico | 0.1% |
| Hawaii | 2% |  |  |

**Geothermal Electric Power Plants**

To make electricity, geothermal power plants use **hydrothermal** resources that have both water (hydro) and heat (thermal). Geothermal power plants require high temperature (300°F to 700°F) hydrothermal resources. We use these resources by drilling wells into the earth and then piping steam or hot water to the surface. The hot water or steam is used to operate a turbine that generates electricity. Some geothermal wells may be as deep as two miles.

**Geothermal Heat Pumps**

*Using the earth's constant temperatures for heating and cooling*

Although temperatures above ground change depending on time of day and season, temperatures 10 feet below the earth's surface are consistently between 50°F and 60°F. For most areas, this means that soil temperatures are usually warmer than the air in winter and cooler than the air in summer. Geothermal heat pumps use the earth's constant temperatures to heat and cool buildings. Geothermal heat pumps transfer heat from the ground (or water) into buildings during the winter and reverse the process in the summer.

According to the U.S. Environmental Protection Agency (EPA), geothermal heat pumps are the most energy efficient, environmentally clean, and cost effective systems used for temperature control. Although most homes still use traditional furnaces and air conditioners, geothermal heat pumps are becoming more popular. In recent years, the U.S. Department of Energy and the EPA have partnered with industry to promote the use of geothermal heat pumps.

**Geothermal Energy & the Environment**

The environmental impact of geothermal energy depends on how it is used or on how it is converted to useful energy. Geothermal heat pumps have almost no negative impact on the environment, and can actually have a positive effect because they may reduce or avoid the use of other types of energy that may have greater negative impacts on the environment.

Geothermal power plants do not burn fuel to generate electricity, so the levels of air pollutants they emit are low. They release less than 1% of the carbon dioxide emissions released by a fossil fuel plant. Geothermal plants further limit air pollution by the use of scrubber systems to remove hydrogen sulfide that is naturally found in the steam and hot water used to generate geothermal power.

Geothermal plants emit 97% less acid rain-causing sulfur compounds than are emitted by fossil fuel power plants. After the steam and water from a geothermal reservoir are used, they are injected back into the earth.

http://www.eia.gov/kids/energy.cfm?page=geothermal\_home-basics